River Basin Management and Restoration: An Ecosystem Perspective

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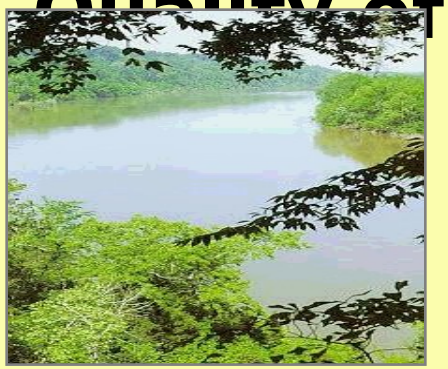
Water Resources and Socie

Needs and Services

- **Food Production**
- **Transport of Goods**
- **Industrial Development**
- **Quality of Life**



Water Resources and Socie

Changing Demands

World population is increasing (estimated to peak at 7.3-10.7 x 10^9 by 2050) .

3,800 km^3 freshwater withdrawal (twice the volume withdrawn 50 years ago).

By 2025, 3.5 10^9 people will live in countries facing severe water shortage (6.5 times the current situation.

Water Resources and Socie

Conflicting Demands

Diversion of water from agricultural to industrial and municipal uses.

Environmental or ecological 'health' balanced against human demand.

Inequity leading to social conflict

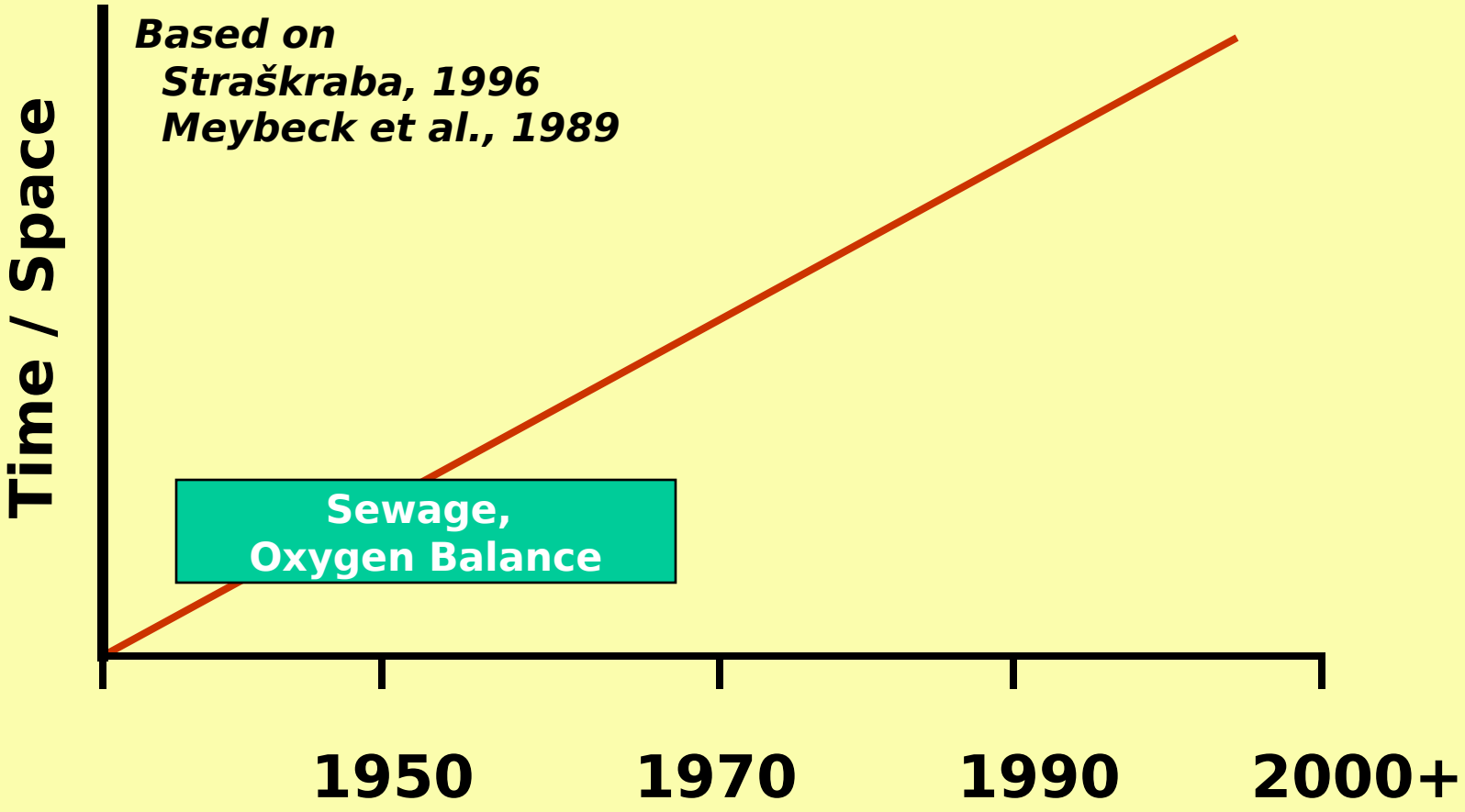
Sustainability

The Inevitability of Development

United Nations Commission on Environmental And Development (1987). Sustainable developm means meeting "…the needs of the present witl compromising the ability of future generations meet their own needs

Basiago (1995). Sustainability is "…regarded as tantamount to a new philosophy, in which princ of futurity, equity, global environmentalism and biodiversity must guide decision making."

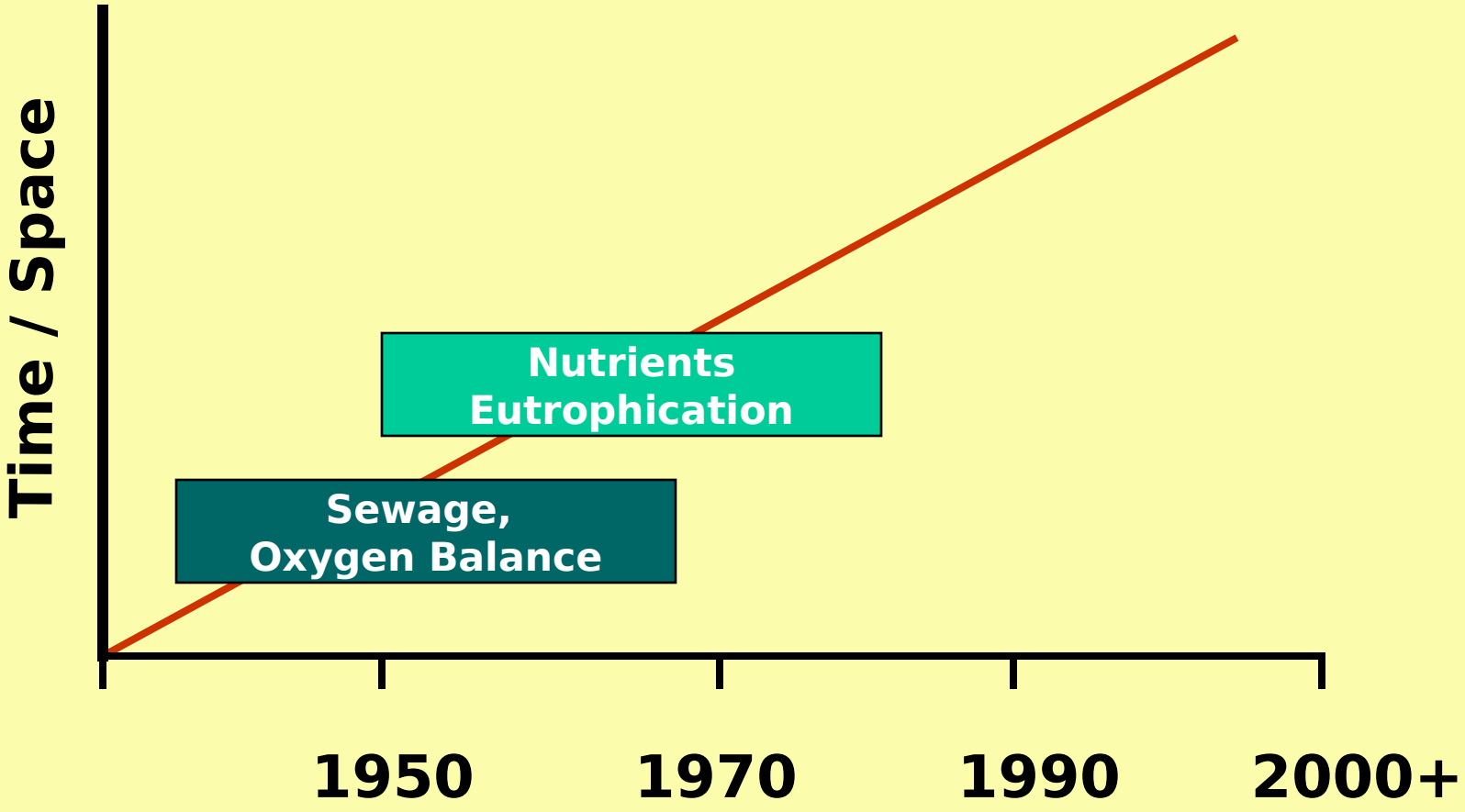
Threats to Water Resources



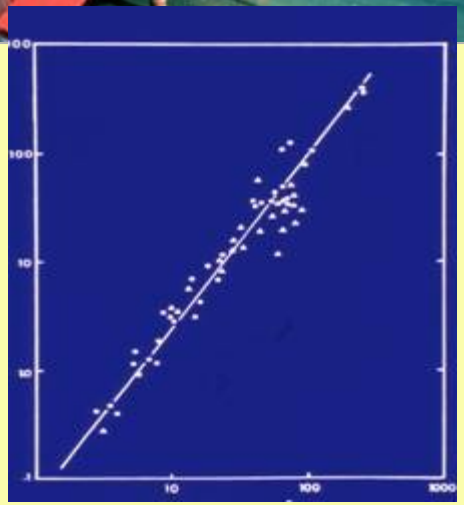
Threats to Water Resourc

- **Dissolved Oxygen Sag**
- **Streeter-Phelps Equation**
- **Waste Load Allocation**

Threats to Water Resourc



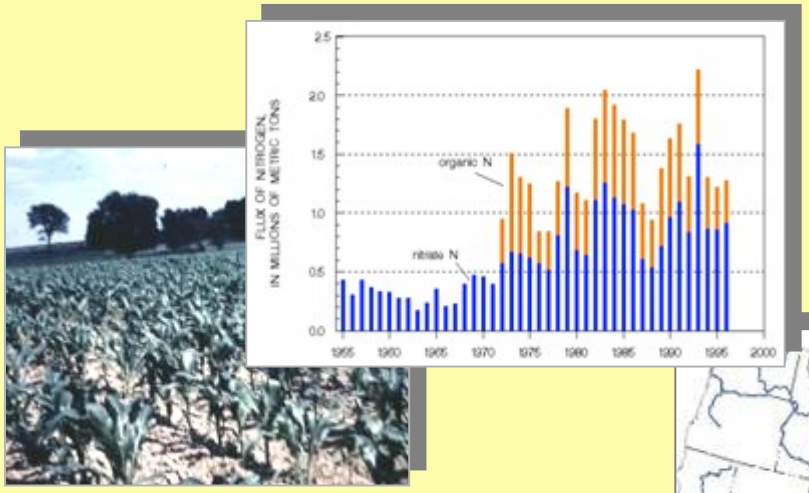
Threats to Water Resourc



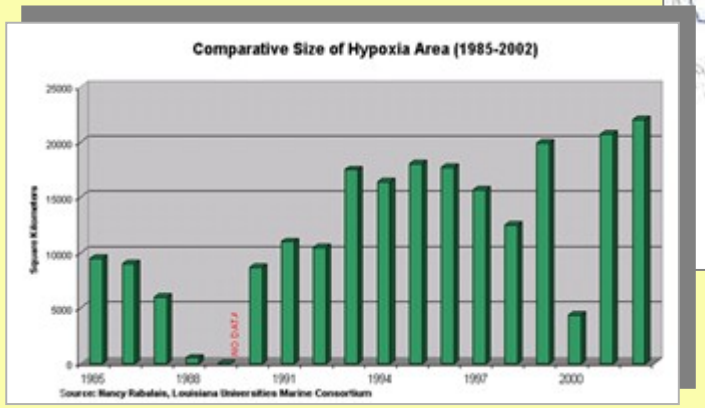
- **Eutrophication**
- **Importance of Nutrients**
- **Point source elimination**

(U. S. Clean Water Act 1972)

Threats to Water Resources



The Importance of Nonpoint Sources



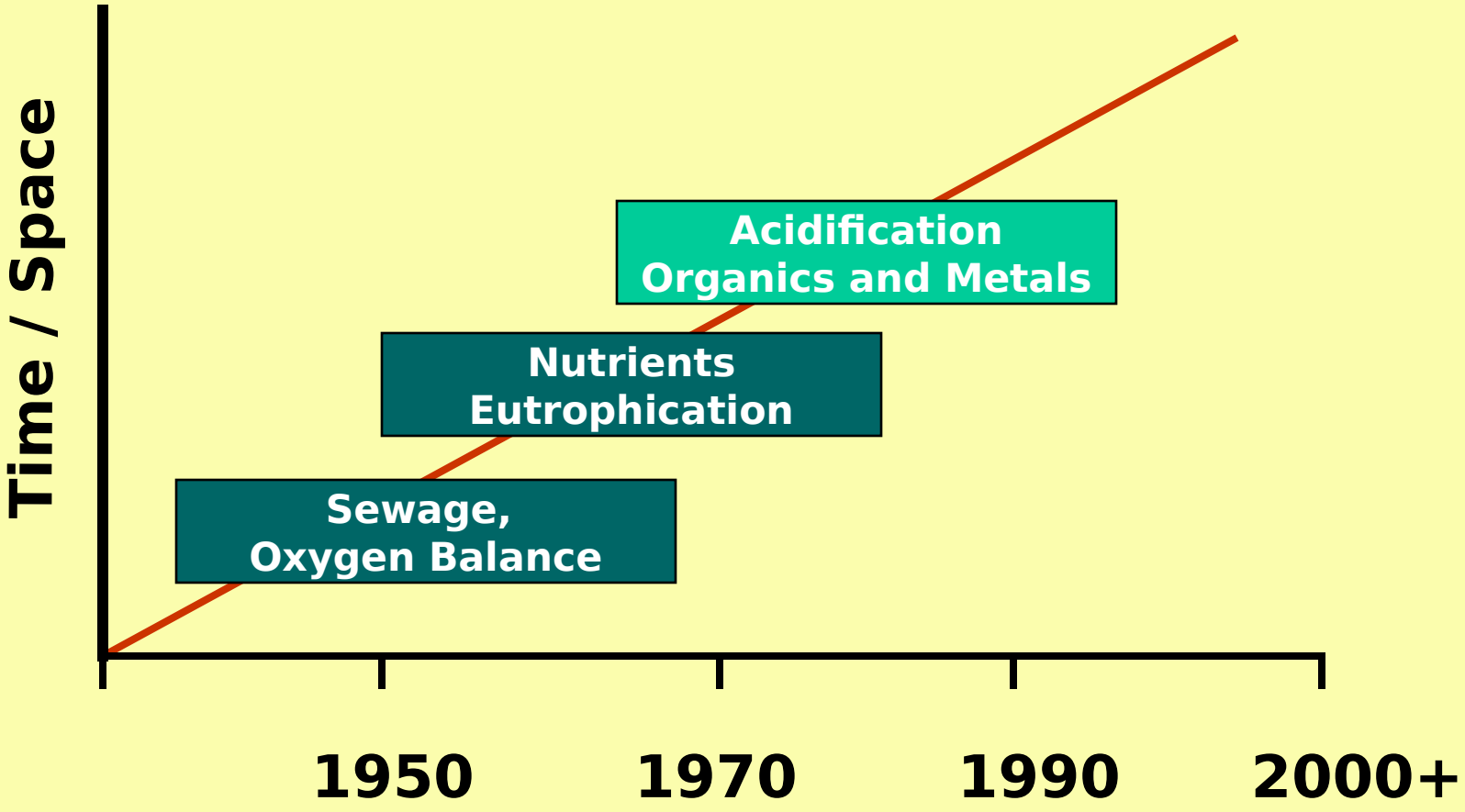
Mississippi River Basin

Threats to Water Resourc

Watershed-Scale Considerations

Danube River Basin

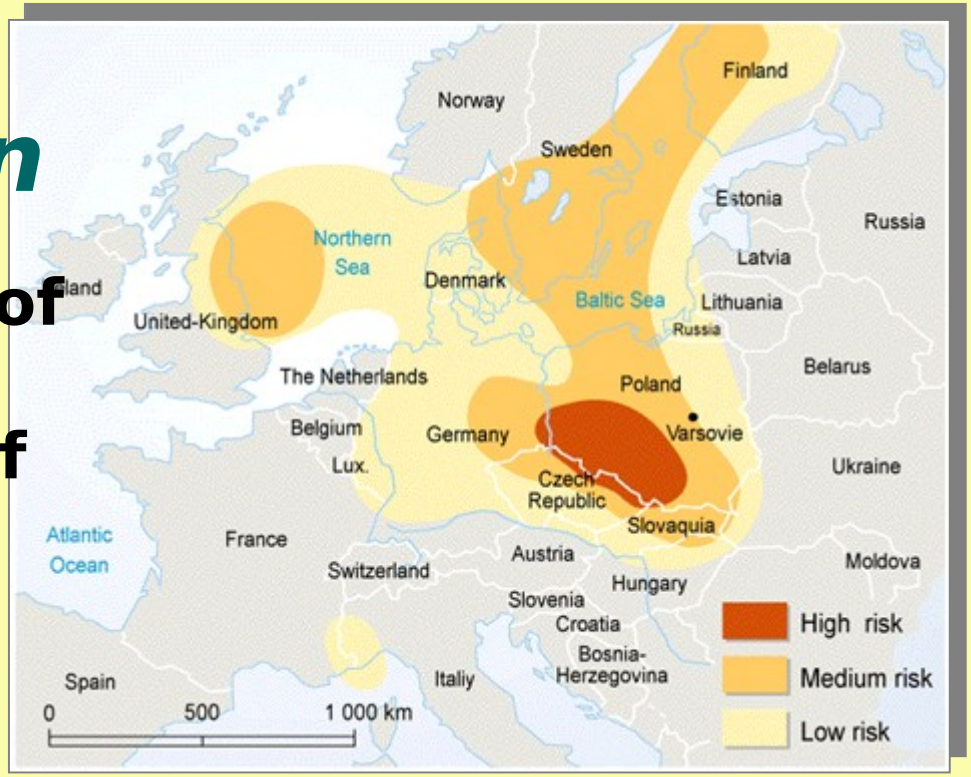
Threats to Water Resources



Threats to Water Resource

Acidification

The importance of air-sheds to our understanding of water resource impacts



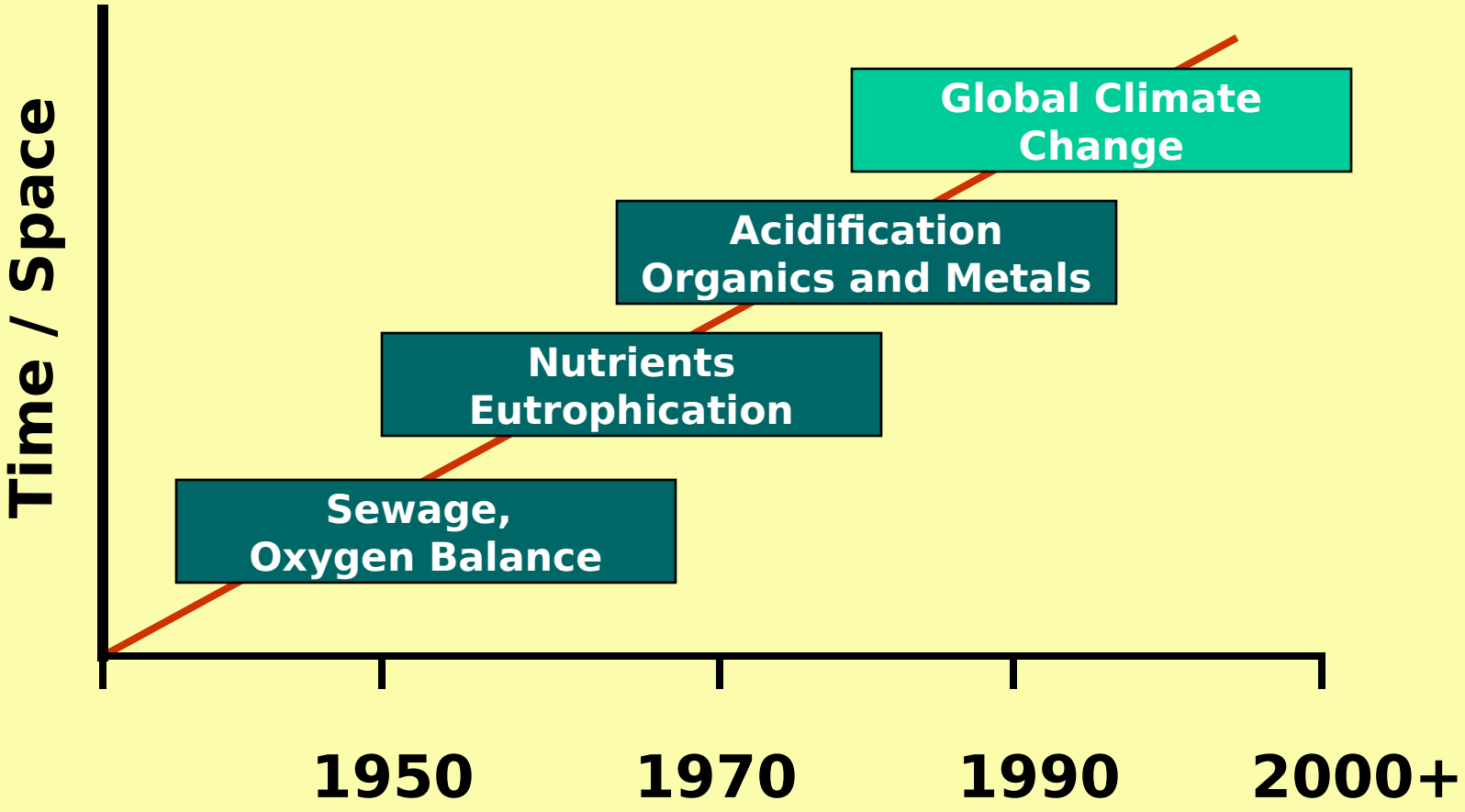
Based on Hatier, 1993 (from UNEP/GRID-Arendal)

Threats to Water Resource

Contaminants

- **Diffuse nature**
- **Long residence tim**
- **Treatment challeng**

Threats to Water Resources

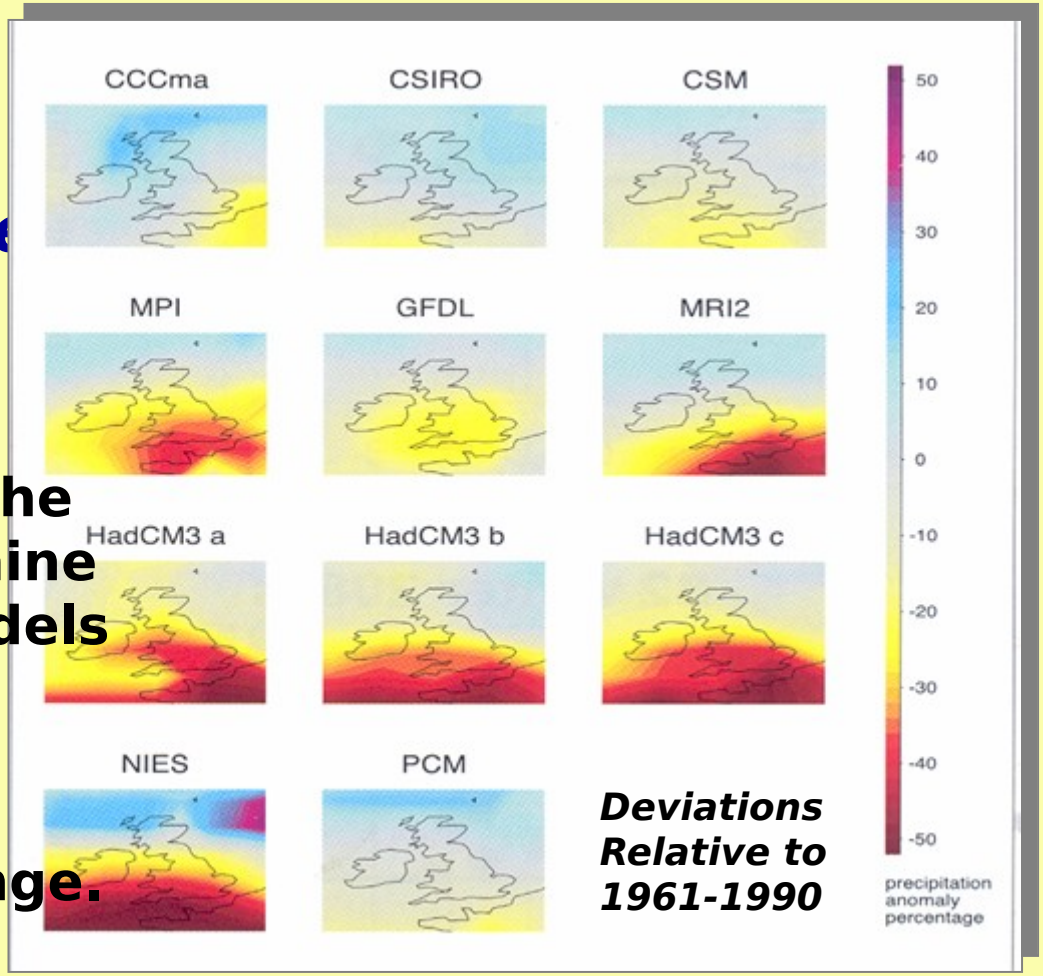


Threats to Water Resources

Precipitation Scenarios for the United Kingdom for 2080

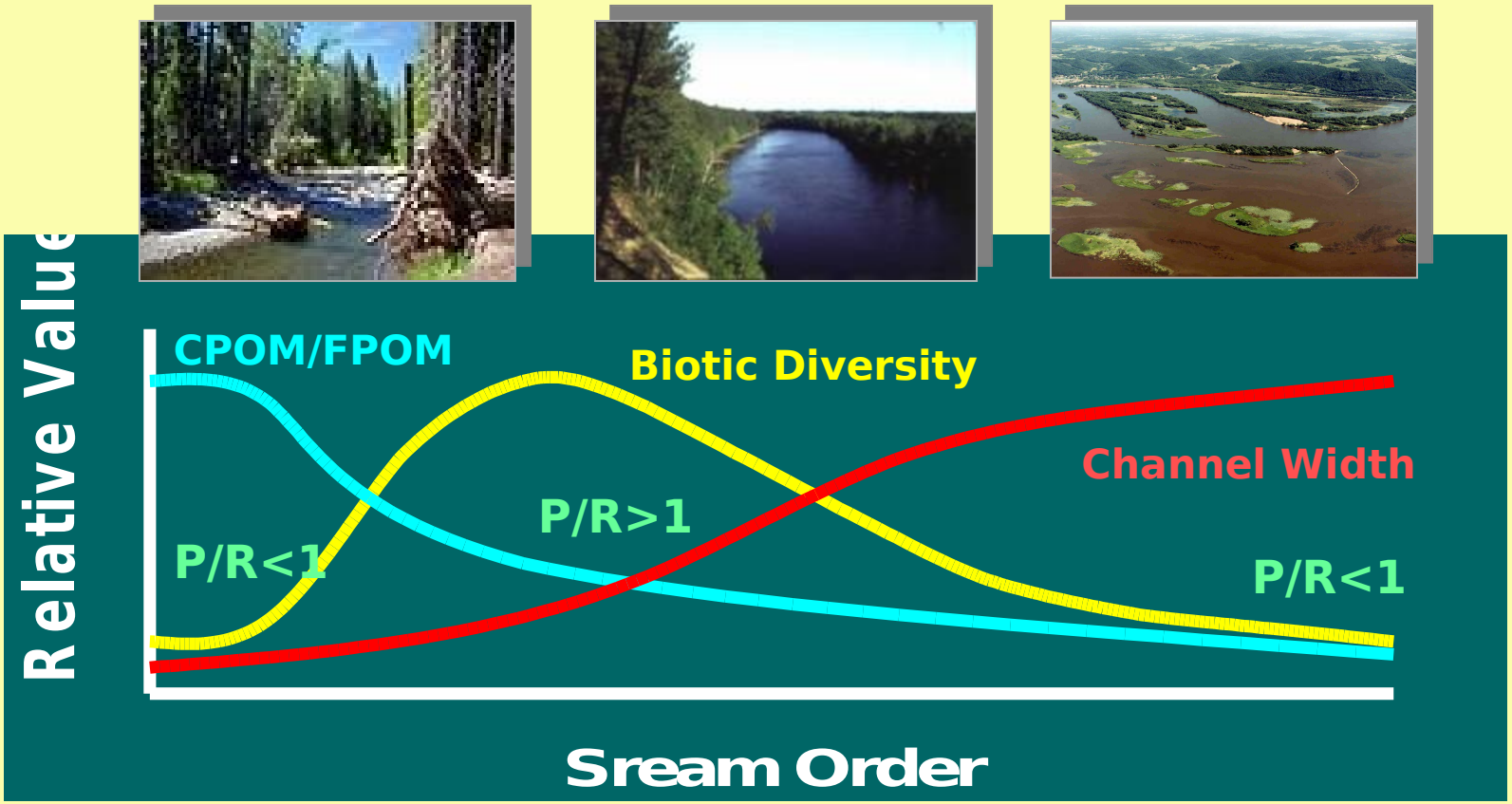
Predictions based the the application of nine climate change models (Hulme et al. 2002)

…there will be change.



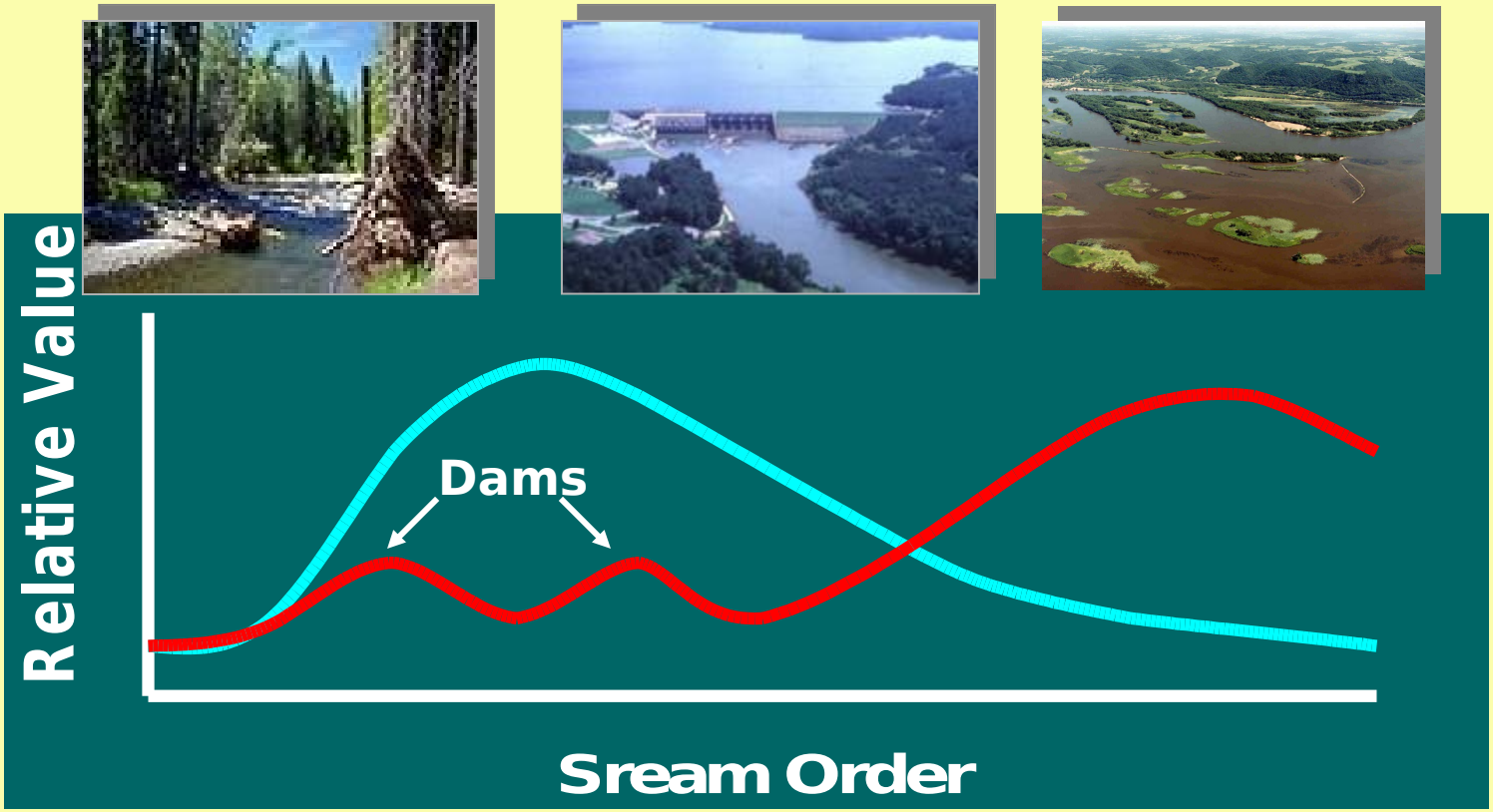
Evolving Concepts

The River Continuum (Vannote et al., 1980



Evolving Concepts

Serial Discontinuity (Ward and Stanford 1998,



Evolving Concepts

Hydrologic Landscape (Winter et al., 1998

Surface Water

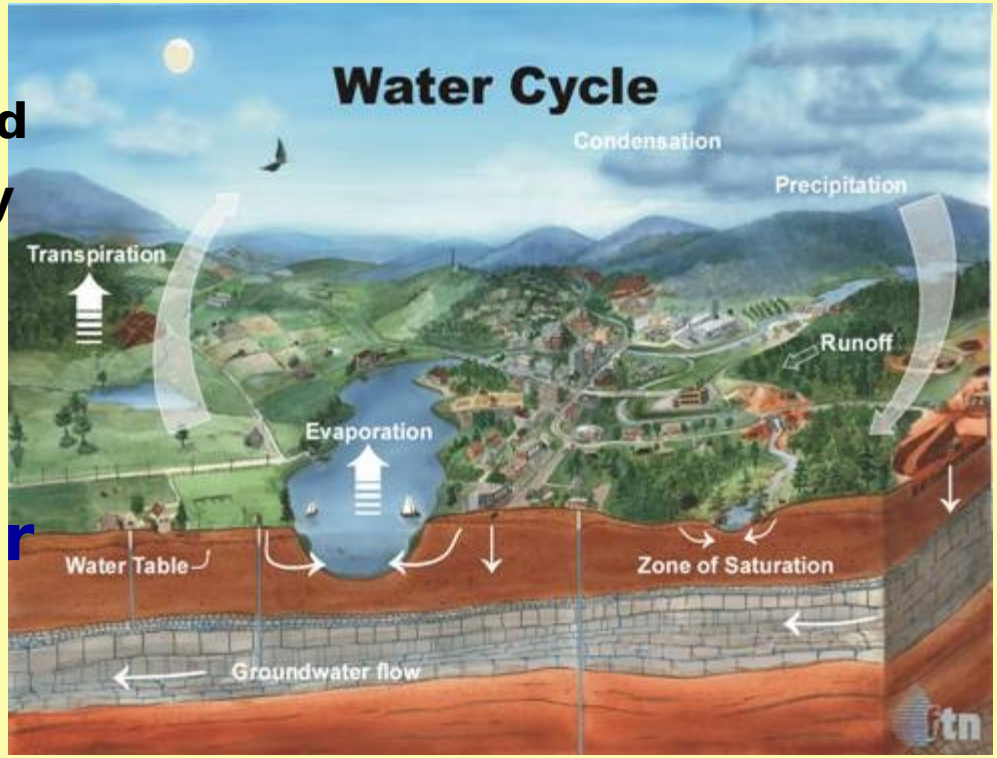
Control by slopes and surface permeability

Ground Water

Control by hydraulic conductivity of the geologic formations

Atmospheric-Water Exchange

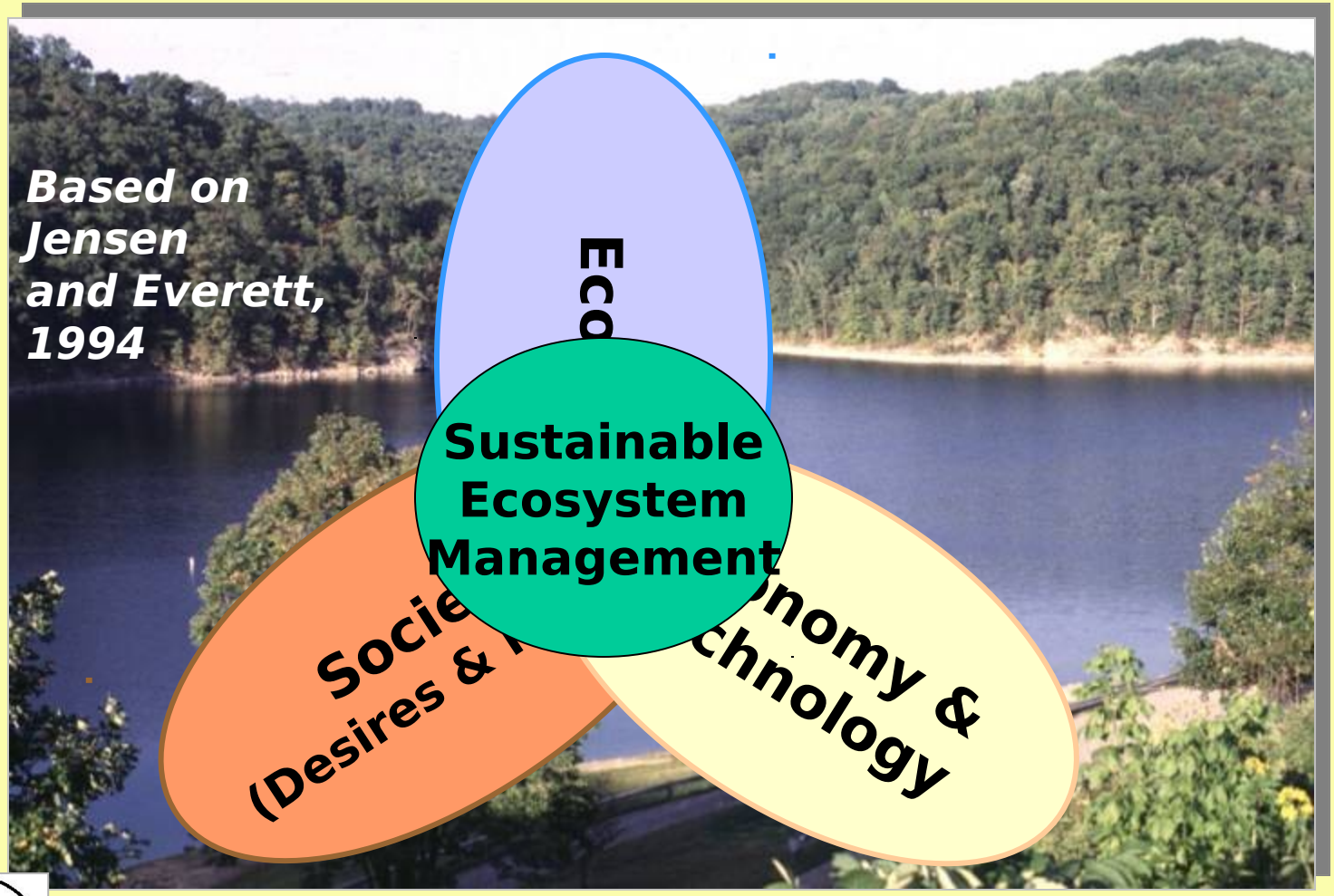
Control by climate



Ecosystem Perspective

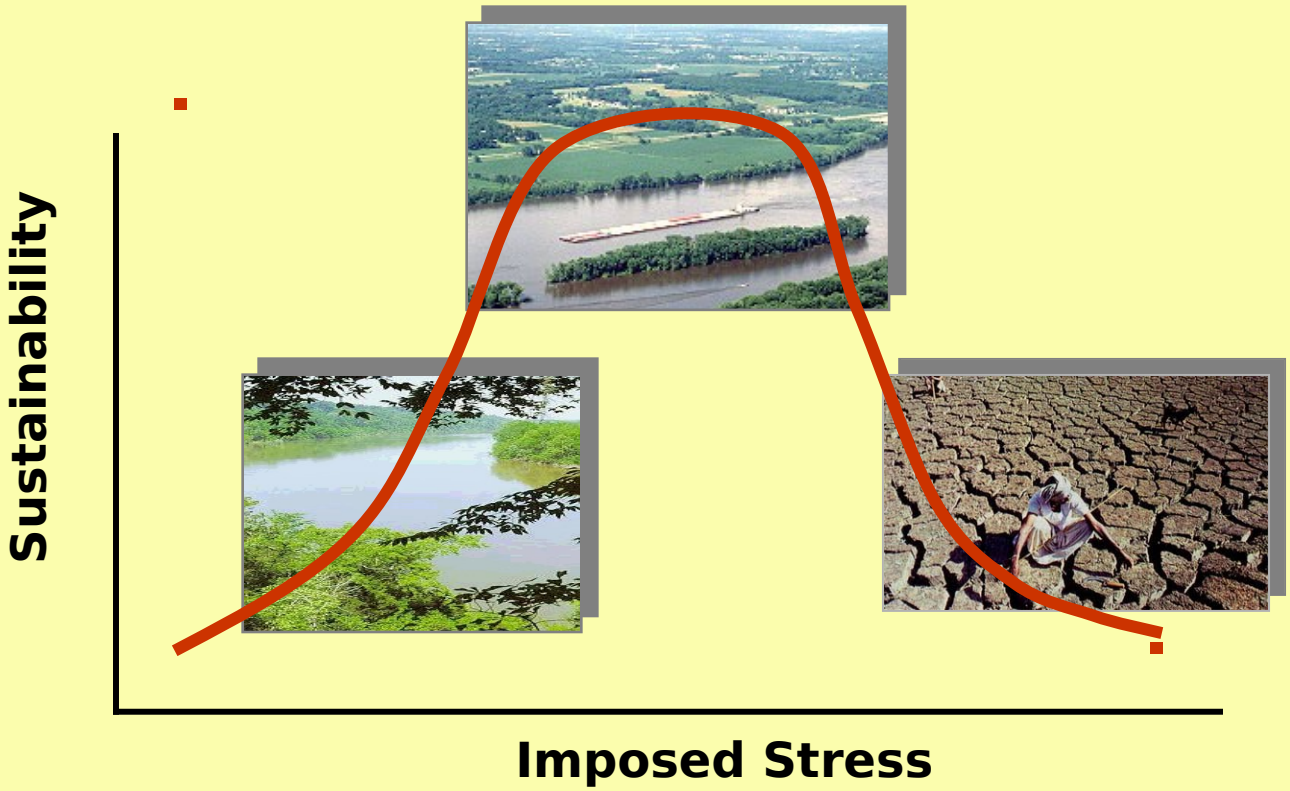
Water Resources as Integral Features of Complex Landscapes….with Competing Demands for their Use

Ecosystem Sustainability



Evolving Concepts

The Challenge of Sustainability



Evolving Concepts

Management and Restoration

Assessment

Reference Condition (setting goals)

- **Pristine or minimally impacted**
- **Conserving key system features (time and space)**

Constraints (policy and planning)

- **Linking cause and effect**

Adaptation and Reassessment

Summary

Themes

- Dependence on scarce water resources
- Threats to their quality and persistence
- Adopting an ecosystem perspective
- Developing concepts
- The challenge of sustainability

Session: River Basin and Delta Conservation and Restoration

Focus

- Danube River and Delta
- Rhine River
- Mississippi River and Delta
- Chesapeake Ba